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The most common complications after wisdom-tooth removal: Part 2: A retrospective study of 1,562 cases in the maxilla

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Abstract: The possible complications of wisdom-tooth removal must be considered, because it is the most common surgical intervention in dental practices. This retrospective study assessed the complications occurring during the removal of 1,562 maxillary wisdom teeth in 1,212 patients. A total of 543 cases of surgical removal and 1,019 cases of non-surgical removal were analyzed. In all cases, a pre-operative panoramic radiograph was taken. Anatomical and clinical parameters were included in the evaluation. 106 complications occurred in 92 patients (5.9%) of the total 1,562 operations. Of these complications, 5.1% were intra-operative and 0.8% postoperative. An oroantral fistula (OAF) was found in 38 cases (2.4%), and alveolar osteitis occurred post-operatively in 6 cases (0.4%). The risk of OAF correlated with increasing patient age ($p=0.0368$). Root fractures also increased the risk of OAF. On the basis of the analysis of pre-operative panoramic radiographs, it was shown that radiological projection of the root tips to the sinus floor is a reliable criterion to assess the risk of OAF.

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The most common complications after wisdom-tooth removal

Part 2: A retrospective study of 1,562 cases in the maxilla

KEYWORDS

Wisdom tooth,
maxilla,
complication,
maxillary sinus,
oroantral communication

SUMMARY

The possible complications of wisdom-tooth removal must be considered, because it is the most common surgical intervention in dental practices. This retrospective study assessed the complications occurring during the removal of 1,562 maxillary wisdom teeth in 1,212 patients. A total of 543 cases of surgical removal and 1,019 cases of non-surgical removal were analyzed. In all cases, a pre-operative panoramic radiograph was taken. Anatomical and clinical parameters were included in the evaluation. 106 complications occurred in 92 patients (5.9%) of the total 1,562 operations.

Of these complications, 5.1% were intra-operative and 0.8% postoperative. An oroantral fistula (OAF) was found in 38 cases (2.4%), and alveolar osteitis occurred post-operatively in 6 cases (0.4%). The risk of OAF correlated with increasing patient age ($p=0.0368$). Root fractures also increased the risk of OAF. On the basis of the analysis of pre-operative panoramic radiographs, it was shown that radiological projection of the root tips to the sinus floor is a reliable criterion to assess the risk of OAF.

Introduction

The removal of wisdom teeth is generally considered the most frequent surgical procedure performed in the dental practice. The most common indication for removal is crowding in the dental arch, which can lead to retention of the wisdom teeth (ALLING ET AL. 1993). Due to growth of the maxillary tuberosity and the greater mesialization of the maxillary dentition, there is more room for buccal eruption, which explains why retention in the maxilla is less commonly observed than in the mandible (STÖCKLI 1994). The retention rate of wisdom teeth in the mandible has been reported to be 9.5% to 39%, which is higher

than in the maxilla (STAGGERS ET AL. 1992, ELSEY & ROCK 2000, YAVUZ ET AL. 2006).

Furthermore, intra- and post-operative complications are observed three times as often in the mandible as in the maxilla. This may be explained by the minimal risk of nerve damage, poorer blood supply, or more frequent retention of saliva and food particles in the mandible (MERCIER ET AL. 1992, TETSCH & WAGNER 1982). Due to the close proximity of the third molars to the maxillary sinus, oroantral communication (OAC) is the most common complication in the maxilla (WACHTER & STOLL 1995). The frequency of post-operative OAC given in the litera-

ture varies between 3.8% (ARRIGONI & LAMBRECHT 2004) and 18.7% (ROTHAMEL ET AL. 2007). It is imperative that dental practitioners be able to treat this complication, since an open maxillary sinus can lead to maxillary sinusitis (KLAMMT 1993).

A panoramic radiograph is the standard pre-operative image used. However, the disadvantages of this imaging technique are magnification and distortion effects, which can lead to misinterpretation of the situation in the wisdom-tooth region as well. These technical factors make it difficult to exactly assess the position of the wisdom tooth's root relative to the maxillary sinus. Computer tomography or cone-beam computed tomography (CBCT) provide more exact data (KOCH 1991, BOUQUET ET AL. 2004, HEURICH ET AL. 2002).

The present study examined the complication rate of surgically and non-surgically removed maxillary wisdom teeth. The aim of the study was to determine risk factors for OAC, which is the most common maxillary complication.

Materials and Methods

Between 2004 and 2005, the maxillary wisdom teeth of 1,212 patients (732 women, 830 men) were surgically removed or extracted at the Policlinic for Oral Surgery of the Center for Dental Medicine, University of Zurich. Only patients who had had a pre-operative orthopantomogram (OPG) taken were admitted to the study. The patients' ages varied from 11 to 82 years, the average being 27 years. Of these 1,212 patients, a total of 1,562 maxillary wisdom teeth were removed. Each wisdom-tooth removal was classified as a separate case. Any supernumerary teeth (tooth nine) were counted as one case and classified as wisdom teeth. Of 1,562 wisdom teeth, 543 were surgically removed, whereas 1,019 were removed in non-surgical procedures.

The retrospective data assessment was done by consulting the medical history. The operators conducted out-patient therapy, surgical techniques, and wound care according to standardized procedures at the Zurich clinic. At that time, it was at the operator's discretion whether or not to apply a dressing (Vaseline-iodine-ether strip with 30% iodine-ether) to the socket of an erupted wisdom tooth. At our clinic today, the packing of the socket is obsolete. After removing a retained wisdom tooth, the wound is sutured. For the post-operative care, the patients received an antiseptic mouth rinse (chlorhexidine 0.2%, Kantonsapotheke Universitätsspital Zürich) and an analgesic or antibiotic (in 33 cases; Amoxicillin 750 mg) according to their general medical history. The first follow-up was a week after the procedure.

The patients were divided into four age groups: group I (patients up to 18 years old), group II (patients ages 18–24), group III (patients ages 25–40), and group IV (patients 40 or more years old). The patients' sex, medical history (underlying medical conditions, medication consumption, nicotine and alcohol consumption), date of the operation, and the indication for the operation were also recorded. The indication for removal of the wisdom teeth was based on prophylactic and therapeutic reasons (for instance, orthodontics, caries, pericoronitis, and cysts).

The teeth were divided depending on their type of retention according to SAILER & PAJAROLA (1996): type 1: tooth bud, type 2: root growth still incomplete, type 3: retention with normal positioning of the axes, type 4: mesially angled tooth, type 5: distally angled tooth, type 6: tooth turned horizontally toward the alveolar process.

A further parameter was determining the relation of the tooth root to the maxillary sinus. The projection of wisdom-tooth roots on the sinus floor visible on the OPG was divided into five classes: class I: sinus floor is above the root(s), class II: sinus floor touches the root tip(s), class III: sinus floor is superimposed on the root up to one-third, class IV: sinus floor is superimposed on the root up to two-thirds, class V: sinus floor extends up to the trifurcation/tooth cervix.

All intra- and post-operative complications were determined and compared to the various parameters. Special attention was paid to the oroantral communication problematic. The data were collected in a database and analyzed (Filemaker Pro 10; Filemaker Inc.). The statistical evaluation was done by means of the Chi-square test. The results that showed a p -value $<5\%$ were considered significant.

Results

Of the 1,212 patients, 54% were male and 46% female, with the average age being 27.4 years. The age group distribution was as follows: group I (patients up to 18 years old) $n=128$, group II (ages 18–24) $n=663$, group III (ages 25–40) $n=601$, and group IV (40 and above) $n=170$. In total, 1,562 maxillary wisdom teeth were removed. In 543 cases, the removal was done surgically, and in 1,019 cases non-surgically.

Overall, 106 complications (5.9%) in 92 cases were recorded, most of which were intra-operative ($n=89$). Oroantral communication (OAC) was the most common ($n=38$), followed by the fracturing of the root ($n=36$). Rare complications included maxillary tuberosity fractures ($n=6$), damaging the neighboring tooth ($n=3$), wounding the lip ($n=3$), prolapse of the buccal fat pad ($n=2$), or the dislocation of remainders of a root into the maxillary sinus ($n=1$). A post-operative complication that occurred six times was alveolitis sicca (dry socket), an abscess was found in five cases, and in one case, relatively strong hemorrhaging occurred. Fourteen patients had a combination of two complications: a root fracture combined with OAC occurred eight times, OAC was found twice with a fracturing of the maxillary tuberosity, damage to the adjacent tooth and OAC was also observed twice; a fractured maxillary tuberosity plus root fracture occurred once, and once a root fracture was found in combination with a dislocation of root fragments into the maxillary sinus.

No significant differences between intra-operative and post-operative complications in male and female patients were found. The rate of post-operative complications was highest in age group III (group III $n=8$, 1.3%), although the distribution of the complications varied. Abscesses were more common in the younger age groups, whereas alveolitis occurred almost without exception in older age groups. The youngest age group revealed only one abscess, and the oldest group only one alveolitis. The only patient with post-operative bleeding was in age group III. Other risk factors, such as smoking or contraceptives, proved to have no influence. Intra-operative complications happened more often in higher age groups (group I, $n=3$, 2.3%; group II, $n=37$, 5.6%; group III, $n=37$, 6.2%; group IV, $n=12$, 7.1%). All intra-operative complications, except for an injury to the soft tissues and a dislocation of root fragments into the maxillary sinus, occurred in older age groups.

OAC was statistically significantly ($p=0.0368$) more frequent in higher age groups (Fig. 1). There proved to be no statistically significant correlation between OAC and jaw quadrant, nor between OAC and the patient's sex. Not one of the 13 cases

where supernumerary teeth (tooth nine) were removed led to OAC.

While examining whether or not there was a connection between the type of retention of the surgically removed tooth ($n=543$) and the occurrence of OAC, it became apparent that in four types of retention, no OAC occurred (type 1 [$n=5$], type 2 [$n=31$], type 4 [$n=5$] and type 6 [$n=3$]). An OAC was most frequent (7.1%) with type 5 retention ($n=14$, 1 OAC), followed by type 3 with 4.9% ($n=485$, 24 OACs). In total, 4.6% of the surgically removed wisdom teeth resulted in an OAC (Fig. 2).

Another question was the association between the spatial root-sinus relation and the occurrence of OAC. Thus, an OPG analysis of the root-sinus relation of all the wisdom teeth in this study was conducted ($n=1,562$). In radiographic projection classes I ($n=96$) and II ($n=224$), no OAC was found. However, OAC was found in five cases (0.9%) in class III ($n=545$), in 13 cases (3.1%) in class IV ($n=414$), and 20 cases (7.1%) in class V ($n=283$). Here, the percentage increased the larger the superimposition was (Fig. 3). The statistical analysis demonstrated that the probability of OAC is significant in class IV ($p=0.03$) and class V ($p=0.0002$). The overall frequency for OAC after removing wisdom teeth was 2.4%, compared to 1.3% for non-surgically removed wisdom teeth.

In eight cases, OAC developed after a root fracture. Root fractures in the radiographic root-sinus projection classes III, IV, V were associated with a higher occurrence of OAC. The relative frequencies of OAC with and without root fractures were also compared. In class III, 0.6% of the cases exhibited OAC without there being a root fracture; with a fracture, however, the frequency increased to 14.3%, thus being about 24 times more likely. Similar behavior could be seen in class IV (2.2% versus 33%), and class V (6.5% versus 40%) (Fig. 4). Therefore, the risk of OAC was higher the further the root was projected on the sinus floor on the OPG, especially if a root fracture also occurred.

Discussion

With a total of 1,212 patients in this retrospective study, the number of cases can be considered representative. Of 1,562 wisdom teeth, 543 were retained and 1,019 had erupted. In the literature, most studies only examined surgical removal, thus ignoring the complications of non-surgical removal of wisdom teeth, which is a more common procedure. In the present study, all complications after surgical as well as non-surgical removal of maxillary wisdom teeth were determined. The rate of intra-operative complications was 5.1% and that of post-operative complications 0.8%. These numbers are similar to

Fig. 1 Relative frequency of OAC by age groups.

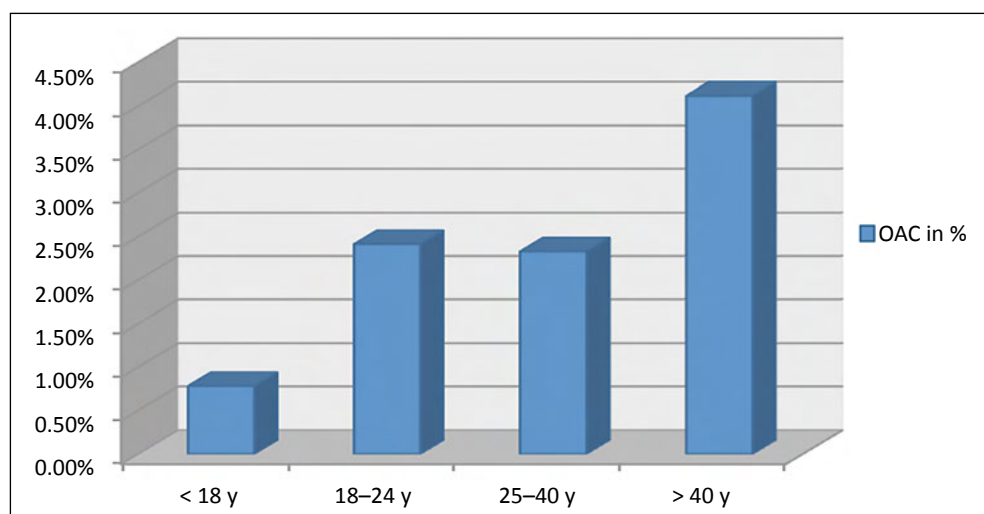
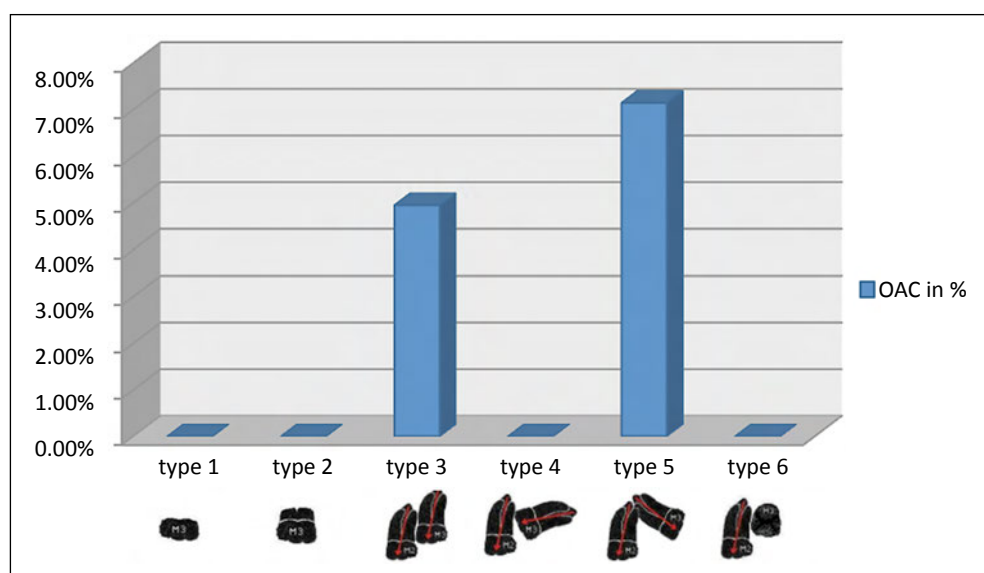


Fig. 2 Relative frequency of OAC by type of retention.



those of CHIAPASCO ET AL. (1993), with 4% and 1.1%, respectively. The present study revealed that the most common intra-operative complication is OAC, which occurred in 38 cases (2.4%). Six cases (0.4%) led to an alveolitis sicca, making it the most frequent post-operative complication.

A literature synopsis by NOROOZI & PHILBERT (2009) indicates that most studies report a 1–4% chance of alveolitis sicca occurring after extraction, if there are no risk factors. However, said studies included extractions from the mandible. According to ALLING & ALLING (1993), alveolitis is ten times as common in the mandible as in the maxilla. In agreement with OGUNLEWE ET AL. (2007), alveolitis in this study was more frequent in the older age groups, but a relationship with other risk factors such as smoking (CHAPNICK & DIAMOND 1992, MOMENI ET AL. 2011) or contraceptives (CHAPNICK & DIAMOND 1992) – which has been mentioned in the literature – could not be confirmed in this study.

The patient's age had no significant influence on post-operative complications. However, similar to this study, ARRIGONI & LAMBRECHT (2004) and VOEGELIN ET AL. (2008) showed that abscesses were more frequent in younger age groups and alveolitis was more common in older age groups.

In the literature, the rate of OAC after surgical removal is placed between 3.8% (ARRIGONI & LAMBRECHT 2004) and 18.7%

(ROTHAMEL ET AL. 2007). In this study, the rate of OAC after surgical removal of wisdom teeth was 4.6%, placing it at the lower end of the range. ROTHAMEL ET AL. (2007), who examined both erupted and retained maxillary wisdom teeth, proved that the occurrence of OAC after surgical removal was almost four times as high (5% versus 18.7%). This outcome matches the results of this study. Here, the rate for OAC after surgical removal was 4.6% and that after non-surgical removal 1.3%. Concerning the age of the patients, this study showed that OAC was more common in older patients, which is in accordance with ROTHAMEL ET AL. (2007). This correlation was statistically significant.

Intra-operative complications relative to the type of retention have been scarcely discussed in the literature. In a comparative study, retained wisdom teeth with distal and mesial inclination of the axis had the highest risk of OAC (LIM ET AL. 2012). In this study, distally angulated wisdom teeth had the greatest risk of OAC. This could be due to the fact that angulated wisdom teeth are more difficult to remove (LIM ET AL. 2012). The number of cases with mesially angulated teeth was too small to be of significance.

The superimposition of root and sinus floor on the OPG has been explored as a possible risk factor in the literature (HIRATA ET AL. 2001). The current study shows that the more the sinus floor

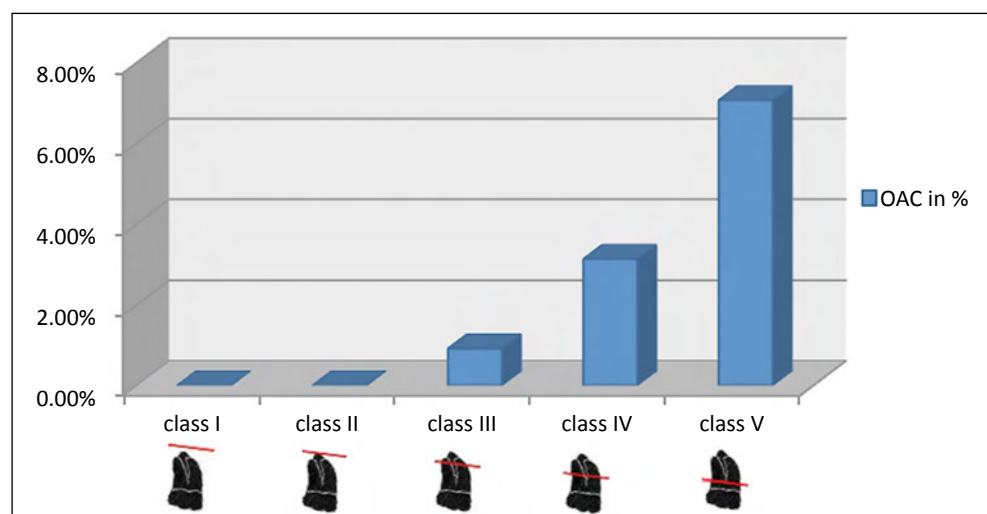


Fig. 3 Relative frequency of OAC by spatial root-sinus relation.

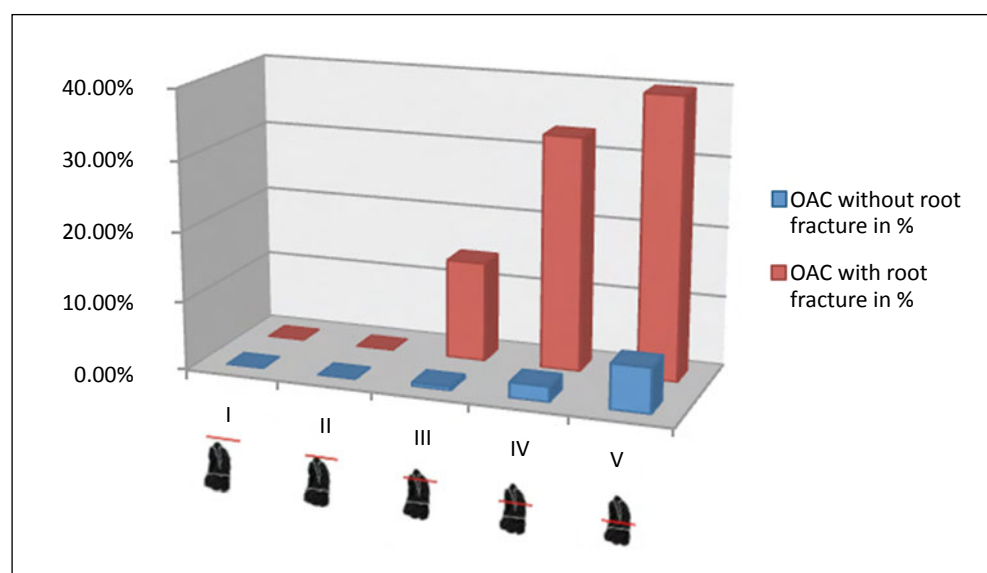


Fig. 4 Relative frequency of OAC with and without root fracture.

was projected on the root, the greater was the relative probability of OAC. SHARAN & MADJAR (2006) analyzed imaging precision. They examined the parts of the premolar and molar roots that were radiologically projected on the maxillary sinus on the OPGs, and discovered that the measured length was twice as long as the real length on the CT. BOUQUET ET AL. (2004) also found a mean difference of +2.2 mm on the OPG in comparison to the CT. According to SHARAN & MADJAR (2006), the roots of 39% of the first two molars and the second premolar protrude into the sinus. If that is the case, an interradicular recess of the maxillary sinus is projected onto the root (KWAK ET AL. 2004) or the roots are projected buccally into the sinus. In all cases where the root apices do not or just barely touch the sinus floor, as in classes I and II of this study, the OPG matched the CT up to 96%. This study demonstrated that there was no OAC in classes I and II of the root-sinus relation. However, the relative probability of OAC increased as of class III, and in classes IV and V it was significantly higher.

This study was able to show that – in cases of distinct superimposition of the sinus – after root fracture, manipulating root fragments poses a greater risk of OAC. ROTHAMEL ET AL. (2007) also proved an increased risk after a root fracture (from 12% to 27%). The authors attributed this to the increased use of force when removing root fragments.

Consequently, this study demonstrates that, if no superimposition of root and sinus floor is visible on the OPG, no OAC is to be expected. Additionally, the risk of OAC is quite low if the root apices just barely touch the sinus floor on the OPG. The risk

increases with the patient's age, displacement of the tooth, root fracture, and superimposition of root and sinus floor shown on the OPG.

Résumé

Lors de l'extraction d'une dent de sagesse, l'intervention chirurgicale la plus pratiquée dans les cabinets dentaires, il est essentiel de tenir compte aussi d'éventuelles complications. La présente étude rétrospective a recensé les complications consécutives à l'extraction de 1562 dents de sagesse supérieures chez 1212 patients. 543 extractions chirurgicales et 1019 extractions simples ont été analysées. Dans tous les cas, un OPT a été effectué au préalable. L'évaluation a été réalisée en fonction de paramètres anatomiques et cliniques. Sur les 1562 interventions, 106 complications ont été constatées dans 92 cas (5,9%), dont 5,1% de complications intraopératoires et 0,8% de complications postopératoires. 38 cas (2,4%) ont montré une communication bucco-sinusienne, tandis que la complication postopératoire la plus fréquente était l'alvéolite sèche (6 cas, 0,4%). L'étude a démontré que le risque de développer une communication bucco-sinusienne augmentait avec l'âge du patient ($p=0,0368$). Les fractures radiculaires entraîneraient elles aussi un risque accru de développer une communication bucco-sinusienne. L'analyse des OPT préopératoires a permis de démontrer que la projection radiologique des extrémités radiculaires dans le plancher du sinus est un critère fiable pour évaluer les risques de développer une communication bucco-sinusienne.

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